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ORIGINAL ARTICLE

Relationship between ED and depression among middle-aged and elderly men in Korea: Hallym aging study

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The aim of this study was to investigate the relationship between ED and depression. The survey was conducted among persons enrolled in panel study about Quality of Life of Korean Elderly Project at the Institute for Aging studies. Subjects were 203 men aged 45–74 years (mean age 65.5 years). ED was assessed by International Index of Erectile Function 5 (IIEF-5) score (Korean version), and depression was assessed by the Geriatric Depression Scale (GDS, Korean version). The baseline questionnaires included demographic and health history information. The age-adjusted prevalence of current depression by GDS ($\geqslant$18), of ED by IIEF-5 score ($<$18), and of concomitant ED and depression were 12.2%, 28.2% and 11.0%, respectively. GDS increased according to severity of ED, adjusted for age, marital status, education, smoking, alcohol, hypertension, regular exercise, total cholesterol level, fasting blood sugar, body mass index ($P<0.001$, by analysis of covariance). ED was strongly associated with depression symptoms after controlling for potential confounding factors using logistic regression. Compared with GDS $<$8, odds ratios and 95% confidence intervals for 12–17 GDS and 18 or more GDS were 3.38 (1.30–8.77) and 6.56 (2.18–19.81), respectively. ED is significantly associated with highly depressive symptoms, regardless of age, health habit or concomitant comorbidity. Our results demonstrate that multidisciplinary approaches are important for the successful treatment of ED.
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Introduction

ED means that satisfactory erection cannot be attained and maintained during a sexual intercourse. ED is a disease with relatively high prevalence and according to recent reports the prevalence of ED among Korean men varies between 31.9 and 70% and it increases with aging.[1–5] Age is the strongest risk factor of ED and other known risk factors include physical factors, such as cardiocerebrovascular disease, hypertension, atherosclerosis, obesity and lower urinary tract symptom, life habit factors, such as smoking, drinking, exercise and eating habit, and psychological factors, such as depression and anxiety.[2,3,6–8]

Several cross-sectional studies during the last several decades have proven the association between depression and ED.[2,6,9–12] The study assessing the relationship between sexual dysfunction and depression might be complicated by difficulties in determining various contributing factors. An increased cardiac risk is not only associated with depression but also with ED.[9,12] A cross-sectional study in Japanese subjects aged 40–64 years demonstrated ED associated significantly with depression in the narrow range of age strata (45–54 years).[6] Whereas The Massachusetts Male Aging Study (MMAS) demonstrated that depressive symptoms measured by the Center for Epidemiological studies Depression (CES-D) were correlated with ED among men aged wide range of age (40–70 years)[9] and explored the causal relation between the two factors through follow-up survey.[13] Although the relation between the depression and ED has been clarified

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through a large number of cross-sectional studies, the association has not been supported through prospective investigation. The prevalence of ED or depression varies across racial, culture and socio-economic backgrounds.[14,15] However, few studies of Asian subjects including well-defined population were reported.[6]

This cross-sectional study was conducted with middle-aged and elderly men dwelling in Korean urban community in order to see whether depression has an independent correlation with ED after related factors to ED such as smoking, drinking and hypertension are controlled.

Materials and methods

Subjects

The subjects of this study were 299 men aged between 45 and 74 years who participated in the 1st Medical Psychology In-depth Survey in 2004, sampled from 1510 Chuncheon residents who answered to a longitudinal study on Korean elders' quality of life (Hallym Aging Study) performed by Research Institute on Aging Society at Hallym University in 2003. Among the subjects, 96 who failed to answer either the depression scale (Geriatric Depression Scale, GDS) or International Index of Erectile Function-5 (IIEF-5) were excluded, and a total of 203 subjects were included in the final analysis. Subject sampling and data collection methods for the Hallym Aging Study are described in detail in the published thesis.[16] This study was approved by Hallym University Sacred Heart Hospital Institutional Review Board.

Data collection

Socio-demographical characteristics, such as age, education level and marital status, behavioral characteristics, such as drinking (non-drinking, past drinking and current drinking), smoking (non-smoking, past smoking and current smoking), and regular exercise, and other data such as past medical history, depression and erectile function were collected through face-to-face interviews by trained interviewers.

Clinical tests such as anthropometry, blood pressure measuring and blood test were performed by the hospital clinical teams (Internal Medicine, Family Medicine, Urology, Laboratory Medicine and Diagnostic Radiology). Height and weight were obtained using an automatic height/weight measurement system (DS-102, JENIX, Seoul, Korea), and body mass index (BMI) using [weight (kg)/height (m^2)]. For blood pressure, after maintaining a stable state for over 10 min, a skillful resident in family medicine measured each of systolic blood pressure and diastolic blood pressure twice and used the mean values. In the blood test, blood was sampled early in the morning after over 10 h fasting. Total cholesterol, triglyceride and fasting blood sugar were analyzed using Hitachi 747 auto-analyzer (Hitachi, Tokyo, Japan).

As a depression inventory, we used the Korean-version GDS developed by Yesavage *et al*.[17] This scale, consisting of 30 questions, is useful to measure depression not only in physically healthy elders but also in elders with a disease or cognitive impairment. The questions can be divided into four factors as follows: general depressive mood (Question No. 1, 3, 4, 5, 10, 17, 22, 25); concern and anxiety (Question No. 6, 8, 11, 13, 16, 18, 23, 29); unhappiness (Question No. 9, 15, 19, 27); and decline in cognitive functions and social activities (Question No. 2, 7, 12, 14, 20, 21, 24, 26, 28, 30). The reliability reported when the scale was developed by Yesavage *et al*.[17] was Chronbach's $\alpha = 0.94$, and the reliability of its Korean version (GDS-K) translated by Jung *et al*.[18] was Chronbach's $\alpha = 0.88$. A high score indicates high depressive mood, and this study used 18 point as the cutoff score for classifying depression.[16] The questionnaire survey was conducted through 1:1 interview in a closed space by interviewers (graduate students at the Psychology Department of Hallym University) who were well informed and trained of the survey method.

IIEF-5 is a self-administered questionnaire for diagnosing ED and measuring its severity, and consists of five questions on erectile function and intercourse satisfaction. Ahn *et al*.[19] performed 'Validation of an Abridged Korean Version of the IIEF-5 as a Diagnostic Tool for Erectile Dysfunction' and suggested 17 point (sensitivity: 0.91, specificity: 0.86) as the optimal cutoff score of Korean-version IIEF-5. This study divided severity of ED according to IIEF-5 into normal (18–25 point), mild ED (14–17), moderate ED (10–13) and severe ED ($\leqslant 9$).[19]

Statistical analysis

In analyzing the association between depression and ED, we excluded elders aged over 75 in consideration of bias caused by age. Because subjects who were visited at their place of residence did not answer the depression scale, we examined the effect of the consequent selection bias by comparing age difference between subjects included in the analysis and those excluded. Based on the IIEF-5 score of 18, the subjects were divided into the ED group (0–17) and the normal group (18–25), and their socio-demographical characteristics, behavioral characteristics, physiological markers and depression level were compared through χ^2 test and Student's *t*-test. Furthermore, in order to analyze the severity of ED according to depression level, we divided the depression level into quartiles, and obtained the

prevalence of ED. The means of GDS were calculated according to the severity of ED by analysis of covariance. In calculating prevalence, age was adjusted to year 2000 national population census in Korea, and in calculating the mean score of IIEF-5, age, education level, smoking, drinking, regular exercise, hypertension, total cholesterol, fasting blood sugar and BMI were adjusted. Variables included in the adjustment were selected based on factors found to be related to ED in a previous study performed with the participants in the Hallym Aging Study.[3] In addition, the odds ratio of ED according to depression level was obtained through logistic regression analysis. We calculated both the age-adjusted odds ratio, which adjusted only age, and the multivariate-adjusted odds ratio, which adjusted all ED-related factors. Last, the mean values of the four factors of depression were calculated according to the presence of ED. All statistical analyses used SAS Version 9.1 (SAS Institute Inc., Cary, NC, USA) and the significance of statistics was admitted if $P<0.05$.

Results

Subjects' socio-demographical characteristics

This study analyzed 203 subjects who answered both the depression scale and IIEF-5 among 299 men aged <75 who participated in the first clinical study. As a number of subjects were excluded in the screening process, in order to test the effect of the resultant selection bias, we compared the 203 participants included and 96 excluded for their mean age (66.1 ± 6.8 years vs 67.1 ± 6.5 years; $P=0.256$) and age distribution (45–54: 10.8 vs 8.3, 55–64: 20.7 vs 18.8, 65–74 years: 68.5 vs 72.9%; $P=0.700$) and confirmed that the two groups were homogeneous. Thus, the effect of selection bias resulting from the exclusion of subjects is considered not significant.

Table 1 shows the socio-demographical characteristics, behavioral characteristics, physiological characteristics and depression level of the ED group whose IIEF-5 score is 17 or lower and the normal group whose IIEF-5 score is 18 or higher. In the ED

Table 1 General characteristics of study population ($N=203$)

	Total N = *203 (%)*	*ED* N = *99 (48.8%)*	*Normal* N = *104 (51.2%)*	P-*value*
Demographic status				
Age (years)				
45–54	22 (10.8)	4 (4.0)	18(17.3)	<0.001
55–64	42 (20.7)	11 (11.1)	31 (29.8)	
65–74	139 (68.5)	84 (84.9)	55 (52.9)	
Education years				
0–6	98 (48.5)	55 (55.6)	43 (41.7)	0.078
7–9	36 (17.8)	18 (18.2)	18 (17.5)	
10⩽	68 (33.7)	26 (26.2)	42 (40.8)	
Married and living together	192 (96.0)	93 (98.9)	99 (96.1)	0.931
Life styles				
Smoking				
None	46 (22.7)	20 (20.2)	26 (25.0)	0.022
Ex	89 (43.8)	53 (53.5)	36 (34.6)	
Current	68 (33.5)	26 (26.3)	42 (40.4)	
Drinking				
None	46 (22.8)	23 (23.2)	23 (22.3)	0.638
Ex	36 (17.8)	20 (20.2)	16 (15.5)	
Current	120 (59.4)	56 (56.6)	64 (62.2)	
Regular exercise	56 (27.6)	22 (22.2)	34 (32.7)	0.095
Physiologic characteristics				
Body mass index ($kg\,m^{-2}$)[a]	25.1 (2.7)	24.9 (3.1)	25.4 (2.3)	0.214
Hypertension[b]	120 (59.7)	63 (65.0)	59 (56.7)	0.233
Blood pressure[a]				
SBP (mm Hg)	138.2 (19.0)	140.2 (21.0)	136.5 (16.8)	0.175
DBP (mm Hg)	82.6 (11.8)	82.3 (12.3)	82.8 (11.4)	0.763
Total cholesterol ($mg\,dl^{-1}$)[a]	195.8 (32.7)	198.6 (33.3)	193.3 (32.1)	0.263
Triglyceride ($mg\,dl^{-1}$)[a]	180.6 (116.0)	171.5 (115.9)	189.0 (115.9)	0.293
Fasting blood sugar ($mg\,dl^{-1}$)[a]	108.6 (31.7)	107.4 (28.7)	109.7 (34.4)	0.610
GDS[a]	11.7 (6.5)	14.1 (6.5)	9.5 (5.6)	<0.001

Abbreviations: DBP, diastolic blood pressure; GDS, Geriatric Depression Scale; SBP, systolic blood pressure
ED: International Index Erectile Function score <18; GDS (range 0–30).
[a]Data were expressed mean (s.d.).
[b]Diagnosed by a doctor as hypertension and/or SBP⩾140 mm Hg and/or DBP⩾90 mm Hg.

group (mild: 19 subjects, moderate: 15 and severe: 65), 84.9% were elders aged 65 or older and the percentage was significantly higher than that in the normal group (52.9%) ($P<0.001$). In addition, the ED group showed a higher percentage of past smokers and a lower percentage of current smokers than the normal group ($P=0.002$). The mean depression score was 14.1 (s.d. 6.5) in the ED group, significantly higher than 9.5 (s.d. 5.6) in the normal group ($P<0.001$). Compared with the normal group, the ED group showed a lower percentage of those doing exercise regularly ($P=0.095$) and a lower education level ($P=0.078$) but the differences were not statistically significant. Others, including marital status, drinking, BMI and hypertension were not significantly different between the two groups.

Association between ED and depression

To obtain indexes stably and perform long-term follow-up observation for the elderly group, we sampled so that subjects aged 65 years or older occupied 70%. Therefore, instead of calculating crude prevalence, we calculated age-adjusted prevalence through direct standardization based on year 2000 national population census.

Age-adjusted prevalence of ED and depression were 28.2% and 12.2%, respectively. For age groups 45–54, 55–64 and ≥65 years, the prevalence of ED was 18.2%, 26.2% and 60.4%, respectively, and the prevalence of depression was 4.6%, 16.7% and 25.2%, respectively, showing the tendency of increasing with aging. Of the subjects, 11.0% had both ED and depression, and the percentage was 4.6%, 7.1% and 20.9%, respectively, in the three age groups. These results suggest that most of subjects with depression experience an ED symptom (Figure 1).

To analyze the association between ED and depression in more detail, we divided the subjects into four groups based on the quartiles of depression score (Q1:0–7, Q2:8–11, Q3:12–17, Q4: ≥18), and compared the prevalence of ED and the score of ED symptom among the groups. In the four groups, the age-adjusted prevalence of ED was 33.3%, 35.9%, 53.3% and 77.1%, respectively. Although the prevalence was similar between Q1 and Q2, it increased markedly from Q3 ($P<0.001$; Figure 2). Furthermore, when ED-related factors were adjusted, GDS mean score of normal, mild, moderate and severe group were 9.2, 11.8, 14.6, and 13.8, respectively. The tendency that the higher ED severity, the higher depression level was observed consistently in the mean score of GDS by ED severity, adjusted by age, education level, smoking, drinking, regular exercise, hypertension, total cholesterol, fasting blood sugar and BMI (Figure 3). GDS consists of four sub-factors (general depressive mood, concern and anxiety, unhappiness, and decline in cognitive function and social activities). In the results of multivariate logistic regression analysis, compared with those with GDS score <8, the risk of ED was 3.38 times higher in those with GDS score between 12 and 17 (95% confidence interval (CI) = 1.30–8.77) and 6.56

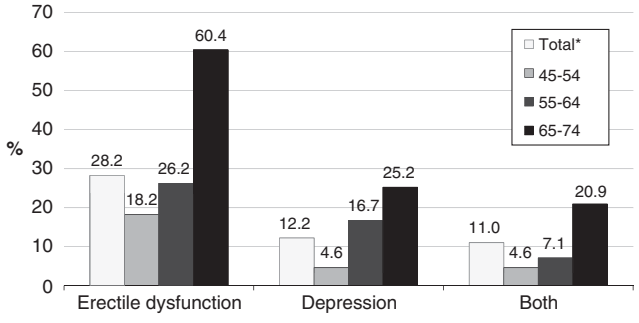

Figure 1 Prevalence of ED, depression and both by age group. ED: International Index Erectile Function (IIEF) score <18; depression: Geriatric Depression Scale ⩾18, *age was adjusted based on year 2000 population census.

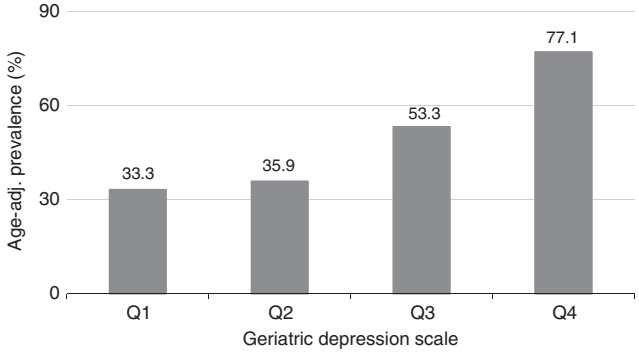

Figure 2 Age-adjusted prevalence of ED by Geriatric Depression Scale (GDS) quartile. $P<0.001$ by χ^2 test. ED: International Index Erectile Function (IIEF) score <18; GDS Q1: 0–7, Q2: 8–11, Q3: 12–17, Q4: 18–30.

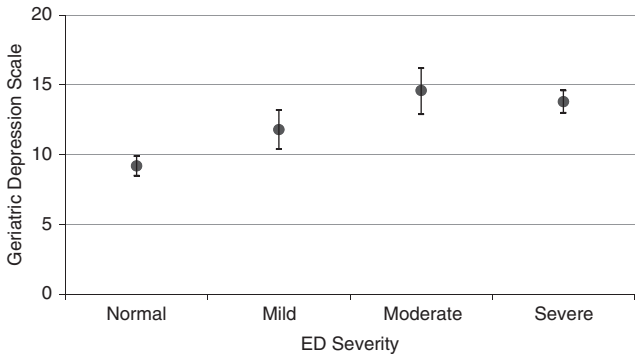

Figure 3 Geriatric Depression Scale (GDS) mean score by ED severity. Age, education years, smoking, drinking, regular exercise, hypertension, total cholesterol, fasting blood sugar and body mass index were adjusted ($P<0.001$ by analysis of covariance). ED criteria: normal⩾18, mild: 14–17, moderate: 10–13, severe⩽9.

Table 2 Associated factors of depression with ED

	ED/normal (n = *99*)/(n = *104*)	*OR* (*95% CI*)[a]	*OR* (*95% CI*)[b]
GDS			
Q1	19/38	1.0	1.0
Q2	19/34	1.10 (0.48–2.51)	1.07 (0.42–2.72)
Q3	28/22	2.66 (1.16–6.09)	3.38 (1.30–8.77)
Q4	33/10	5.68 (2.24–14.42)	6.56 (2.18–19.81)

Abbreviations: CI, confidence interval; GDS, Geriatric Depression Scale; OR, odds ratio.
ED: International Index Erectile Function score <18; GDS, Q1: 0–7, Q2: 8–11, Q3: 12–17, Q4: 18–30.
[a]Age was adjusted.
[b]Age, marital status, education years, regular exercise, body mass index, smoking, daily ethanol intake, GDS, fasting blood sugar, total cholesterol and hypertension were adjusted.

Table 3 The difference in mean scores of each GDS factors by ED

	ED (n = *99*)	*Normal* (n = *104*)	P-*value*
Geriatric depression scale factors			
General depressive mood	5.5 (0.32)	3.5 (0.30)	<0.001
Concern and anxiety	3.6 (0.27)	2.4 (0.25)	<0.001
Unhappiness	0.75 (0.11)	0.40 (0.10)	0.015
Decline in cognitive functions and social activities	6.5 (0.28)	5.1 (0.26)	<0.001

ED: International Index Erectile Function score <18.
Age, marital status, education years, regular exercise, body mass index, smoking, daily alcohol intake, GDS, fasting blood sugar, total cholesterol and hypertension were adjusted.

times higher in those with GDS score ≥18 (95% CI = 2.18–19.81; Table 2). Last, to test whether ED is more closely correlated with any specific one of the four sub-factors of depression, we compared the mean value of each factor between the ED group and the normal group. In the comparison, variables found to be related to ED in previous studies were adjusted. According to the results, the ED group showed a significantly higher depression level than the normal group in all of the four factors (Table 3).

Discussion

We found the severity of comorbid depression is highly associated with the severity of ED. Age-adjusted prevalence of ED was 28.2% that was twice that (12.2%) of depression in Korean aged men. Those with both ED and depression were 11.0, and 39.0% of subjects with ED symptom had also depression while 90.2% of subjects with depression had comorbid ED (Figure 1). These results suggested that depression may not be casually related to ED. When the subjects were divided into four groups according to GDS quartile (Q1:0–7, Q2:8–11, Q3:12–17 and Q4: ≥18) and the prevalence of ED and the IIEF-5 score were compared among the groups, the prevalence of ED increased markedly. The means of GDS with adjusting ED-related factors significantly increased with ED severity. In Japanese study, Sugimori *et al.*[6] reported that the prevalence of ED and depression in subjects who had coronary heart disease was 76% and 47.9%, respectively, higher than 28.2% and 12.2% observed in our study, even though mean age of subjects is lower than that in our study (51 years vs 66 years). Those results showed that depression and ED are associated with increased cardiac risk. The results of this study are consistent with the results of many previous cross-sectional studies.[2,9,12,20–24] In the MMAS, a cross-sectional study ($N = 1265$) conducted from 1986 to 1989 with randomly sampled men aged between 40 and 70 years who were aging normally and healthily, the odds ratio of moderate or completed ED with adjusting related factors was 1.8 (95% CI = 1.21–2.73) in depressive subjects (16 ⩾ CED-S (the Center for Epidemiological Study's Depression scale)) compared with non-depressive ones.[9] The authors formulated a model for understanding the complex and dynamic relation between depression and ED, which is based on the disablement process applying by Verbrugge and Jette.[25] According to the model, depression and ED interact with each other, and they are a risk factor as well as an exacerbating factor of each other. Mulat *et al.*[12] studied the correlation between ED and depression with male coronary artery disease patients ($N = 242$, mean age 63.7 years). They reported that in the general linear model, ED showed a correlation with depression (Mental Health Inventory 5 (MHI5) score), and emphasized the clinical meaning that even a minor change in depressive symptoms influenced ED independently.

In Korea, Moon *et al.*[20] examined the relations among sexual dysfunction, depression and sexual role through a case–control study. The patient group ($N = 21$, mean age 46.6 years) was sampled from those who visited the Sexual Function Center of a university hospital in Seoul and were diagnosed with psychogenic ED, but without any organic cause of ED, comorbidities and psychiatric history, and the control group ($N = 30$, mean age 44.1 years) was sampled from men without sexual dysfunction and past clinical history. The subjects had an induced erection test under visual and auditory stimuli and answered Beck's Depression Inventory (BDI) and Bem's Sexual Role Inventory. The mean BDI of the ED group was 15.7 (s.d. 7.9), significantly higher than the control group (mean 7.9, s.d. 6.5; $P < 0.01$). Although not statistically significant, the sexual dysfunction group included more people with feminine personality than the control group, and it was reported that those with feminine personality might be more sensitive to sexual dysfunction and,

consequently, more depressed. Recently, Jeon *et al.*[2] sampled 40-year-old or older men who visited the Department of Urology for ED as a self-reported group and men who visited for other diseases as an unreported group, and measured ED and depression using IIEF-5 and CES-D, respectively. Among them, 39.8% were diagnosed with ED (<21 IIEF-5), of which 25.9% were in the unreported group and 13.9% in the self-reported group. However, the severity of ED was higher in the self-reported group. Furthermore, those with ED in the self-reported group showed a significantly higher depression symptom score than those with ED in the unreported group. This suggests that, regardless of diagnosis or severity, one's perception of ED symptom is closely associated with his depression. They reported that depression may have a mediatory effect on ED or ED patients' psychological problems such as low confidence may cause or aggravate depression.

Although most of previous studies in Korea and other countries reported association between depression and ED, Kantor *et al.*[11] did not observe any relation between depression and ED (odds ratios = 1.3, 95% CI = 0.5–3.1). They measured the prevalence of depression and ED in 199 subjects (mean age 59 years) sampled at random from 73 hospitals in Pennsylvania. The prevalence of ED increased with age, but the prevalence of depression and that of depression accompanied by ED did not show the tendency of increasing with age. As to the reasons for not observing association between depression and ED, they mentioned: first, the sample size might be too small to guarantee statistical power; and second, the low concomitant prevalence of depression and ED might limit the possibility of modeling the association between the two factors adequately.

The association between depression and ED has explained by four theories.[7] The first theory hypothesizes that common factors may cause both depression and ED. For example, endothelial dysfunction and reduced testosterone are known to be the risk factors of both depression and ED in male elders.[24,26] The second theory hypothesizes that both ED and depression may be the results of another disease such as atherosclerosis. The third theory hypothesizes that because the two diseases are both comorbidities showing high prevalence in the elderly population group they seem to be associated with each other. The last theory hypothesizes that the two factors are in a causal relation. Depressive mood comes from negative thinking, decreases interest and vitality, and lowers self-esteem. Because of these characteristics, depressive men may have significantly reduced sexual desire[27,28] and nocturnal penile tumescence[29,30] compared with non-depressive ones. On the contrary, ED may precede depression. That is, men with ED may have depression developed from the loss of sexual function. In the ELIXIR study, 76% of patients with untreated depression had a difficulty in sexual arousal and 24% had ED,[29] and Kennedy *et al.*[30] reported that 46% of depressive men could not maintain erection. More biologically, with regard to the relation between depression and autonomic nervous system dysfunction, a low-level vagal tone may deteriorate the smooth muscle relaxation function of erectile tissue.[24] Seidman *et al.*[31] performed a randomized clinical trial with 152 patients who had mild or more severe depression and ED. The patient group treated with sildenafil citrate for ED for 12 weeks showed a remarkable improvement in their depression compared with the placebo control group. Rosen *et al.*[32] who used verdenafil reported the same results. They argued that the result is powerful evidence showing the possibility that sexual dysfunction may be caused by depression. These results of clinical experiments mean that the treatment of ED may have the simultaneous effect of relieving depression. On the contrary, 22–41% of elders who take antidepressant agent experience ED. Therefore, drugs should be selected carefully for depression patients in order to minimize the risk of causing or exacerbating sexual dysfunction.[33]

Prospective studies for exploring the causal relation between the two factors reported conflicting results.[13,34] In the follow-up of MMAS from 1995 to 1997 (mean follow-up period 8.8 years, follow-up rate 52%), the presence of depression in the baseline survey was not a significant predictor of the occurrence of ED ($P = 0.12$).[13] What is more, the percentage of those who came to have ED was higher among those without depression in the baseline survey (13.2% vs 21.3%). They suggested that depression is not a cause of ED. The association observed in previous cross-sectional studies demonstrates that ED causes depression or that two diseases coexist simultaneously. They also suggested that the risk of ED might exist in those with endogenous depression or severe depression rather than in most of men with depression. Last, they explained that the effect of depressive symptom on ED was temporary, lasting only during being in the depressive state. In such a case, it might be impossible to conclude whether depression affects ED through the follow-up period of the study, which was 8.8 years on the average. Severe depression lasts longer, affects the autonomic nervous system, increases vagal, sympathetic tone and platelet aggregability, and lowers compliance to treatment, and therefore, the chronic effect of depression may influence ED over a long period.[12] De Berardis *et al.*[34] performed a prospective study with 670 type 2 diabetic patients in order to identify predictors of ED. They measured the severity of ED and depression through a questionnaire survey in every 6 months for 3 years. ED occurred in 192 type 2 diabetic patients and the incidence was 166.3 per 1000 persons. Age, insulin therapy, hemoglobin A1C, cholesterol and severe depression were found to be predictors of ED. Compared with the low-level

depression patient group (<16 CES-D score), the high-level depression patient group (≥21 CES-D score) had 1.5 times higher risk of ED (95% CI = 1.0–2.23). Together with the previous reports, the authors concluded that depression might accelerate the occurrence of ED and even work as an exacerbating factor.

This study has some limitations. First, this study is a cross-sectional study, having a limitation in explaining the causal relation between the two factors. However, the outcome of this study may be useful as a baseline survey result for proving the causal relation through follow-up studies, and most of all it can be an importance source for observing the spontaneous resolution of ED and depression through periodical follow-up study. Furthermore, although it was a cross-sectional study, the results were obtained from community residents, so can be generalized to other population groups. Second, there is the possibility of selection bias. This study excluded 96 subjects who did not answer either GDS or IIEF-5. However, when age was compared between the included group and the excluded group, no significant difference was observed between the two groups. Accordingly, selection bias resulting from the excluded subjects might not be significant. Furthermore, we included those taking antihypertensive drug, which is known to cause ED, in the analysis, but because the prevalence of hypertension and that of antihypertensive drug were not significantly different between the ED group and the normal group and the inclusion might not have a significant effect on the results. Third, depression and ED were measured not only by clinical tests but also by GDS and IIEF-5 questionnaires. Currently, structured questionnaires are used clinically as depression screening tools, and IIEF-5 is applied by World Health Organization as a gold standard for ED diagnosis.[25] Furthermore, because this study was performed with a number of residents, it was considered adequate to use a reliable questionnaire.

In conclusion, the author observed that ED was strongly associated with depressive symptoms in population-based cross-sectional study, regardless of age, health habit or concomitant comorbidity. The etiology of depressive symptoms of aging is multifactorial. The men who have concomitant cardiovascular disease and depression is more likely to have ED.[31] Age-related low testosterone significantly associated with ED as well as with depression on the basis of epidemiological and clinical studies.[9,35,36]

It still has many questions to be solved due to lack of prospective studies. In order to answer the questions, it is essential to carry out large-scale prospective studies designed to survey depression and ED repeatedly and periodically. Previous cross-sectional studies suggest that if one has either ED or depression or both, various factors should be evaluated and careful follow-up should be carried out along with treatment.

Conflict of interest

The authors declare no conflict of interest.

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